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LAND FORMING

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Land forming is a surface drainage system using wide, shallow, V-shaped ditches in combination with land smoothing. It has been used successfully since 1947 on poorly drained silt loam soils in north central Wisconsin.

Land forming makes use of one or more outlet ditches or waterways down the main slope, shallow feeder channels across the slope, and land smoothing on the intervals between the cross-slope drains.

Land forming has two objectives: (1) provide drainage by eliminating small depressions which often remain wet after the rest of a field is dry enough to farm, and (2) control erosion on sloping land.

The late A. J. Wojta developed and improved this system in the decade following 1947. Today land forming is widely accepted as an excellent system for improving productivity of such soils through better surface drainage.

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Why Use Land Forming?

The primary purpose of land forming is to provide a uniform land surface that will move water evenly. This is an especially useful tool for efficient crop production and soil management.

Land Forming Saves Water. It uses a system of waterways and shallow surface drains to collect and slowly carry water from the field. This lets more water filter into the soil and reduces run-off. It spreads water uniformly over the soil surface, making full use of rainfall for crop production.

Field Work is Easier and More Efficient. Land forming promotes uniform soil moisture over the entire field -- it eliminates wet spots which mire machinery. Large fields can be worked at desired moisture content. Farm machinery is easier to control and can operate at higher speeds. The more uniform ground surface makes planting and harvesting easier.

Better Soil and Crop Management is an important result of land forming. Fields dry out earlier in spring. Crops can be planted earlier and can grow and mature more uniformly over the entire field. Tillage, planting, and harvesting can be timed on the basis of large field units for more efficient management.

Crop Yields Increase. In land forming experiments from 1949 to 1953 at the Marshfield Branch Experiment station and six other area farms on similar soil types, oat and forage yields increased considerably. Forage yields were highest on areas improved by a combination of several soil management practices -- land forming, liming and fertilization, and establishment of adapted grasses and legumes. In wet years, land formed fields produced a good oats crop and legume stand, in contrast to oats failure or a grassy and weedy stand on unimproved areas.

On the clay loam soils at the Ashland Branch Experiment Station, land forming increased grain and forage crops yields significantly, primarily because many low wet spots were brought into production. Dependable production in wet years is assured -- fields dry faster in spring and after heavy showers in summer and fall.

Laying Out the System

Land forming systems are laid out to eliminate low areas with a minimum of earth movement and to provide a surface that can be readily farmed and easily maintained with regular farm equipment. Each field must be planned as a separate watershed unit with its own system of outlet ditches down the major slope and intercepting channels across the major slope.

The outlet ditch system is developed around the natural waterways of the field. Outlet ditches are V-shaped with sides sloping 8 to 10 feet for every foot of depth. These ditches, or waterways, are located up and down the major field slope and graded with the slope. On flat fields, lower sections are deepened for additional grade.

V-shaped outlet ditches are dug deep enough to drain the field channels. Proper outlets through adjacent areas must be provided. Soil from construction of these ditches is used to fill low areas of the field or is feathered out on the sides of the outlet ditches. These waterways must be built without raised banks so flood waters can back up into the field and, as water recedes, re-enter the outlets.

Where erosion is slight, large waterways aren't needed. Furthermore they are costly and create a nuisance in the field. Also, studies show that ditch depths up to 2 feet don't materially affect the subsurface field drainage.

It is best to construct these waterways at least one year before field channel construction to allow time for sod to establish.

Field channels are V-shaped ditches excavated 6 to 8 inches deep and 10 to 12 feet wide. They are located across the slopes on gradients of 0.1 to 0.6 feet per 100 feet. They drain into the V-shaped outlet ditches. These "eave troughs" gather runoff from the smaller field areas and protect the lower slopes from excessive water. They are generally laid parallel and spaced 150 to 300 feet apart.

If the land slopes so that erosion is a problem, then cross-slope channels are spaced according to recommendations for erosion control terraces. On fields with numerous potholes, or on very flat fields, 150 feet spacings are used. However, flat areas can be graded to increase fall and reduce the number of cross-slope channels needed.

Construction of these channels also provide soil to fill low areas. Surplus soil is used to form a low, broad ridge, a few inches above ground level and 5 to 10 feet wide on the lower side of the channel so the finished channel has an effective depth of at least 9 inches. This feature helps field water drain into the channel. The added height of the ridge increases channel capacity, and on very flat fields it increases slope of land between channels.

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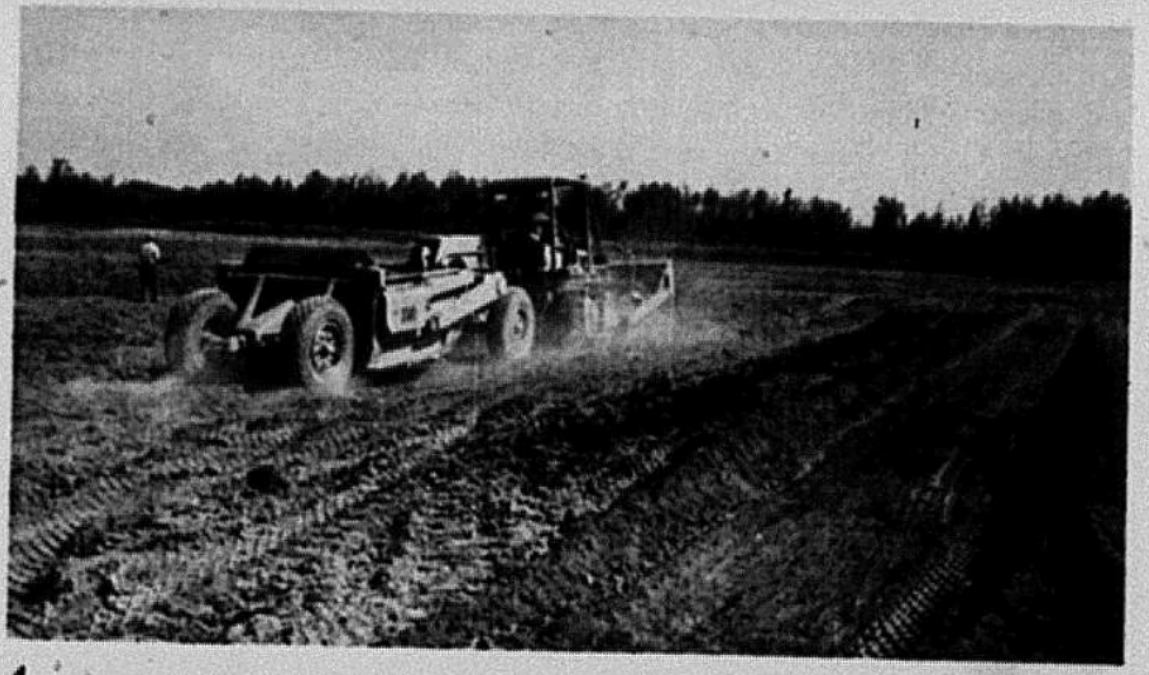
Summary of Steps

- Lay out drainage system of the field. Get help from the Soil Conservation Service. ACP assistance must be approved before work is started.
- Rough grade the outlet ditch system and the cross slope channels to establish the overall grade of ditches and channels. Use soil from construction to fill in prominent low spots.
- Work deep, mix and loosen soil thoroughly.
- Use the smoothing machine to eliminate surface irregularities. Finish the grade of the V-shaped ditch and channel system with this machine.



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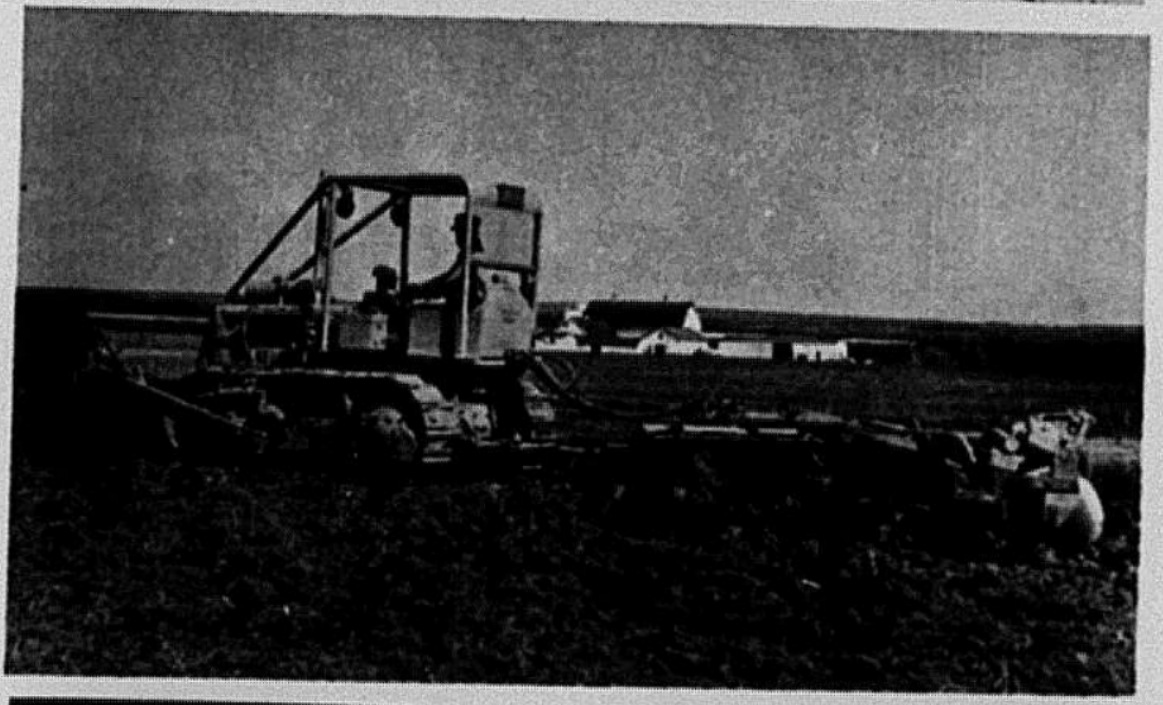

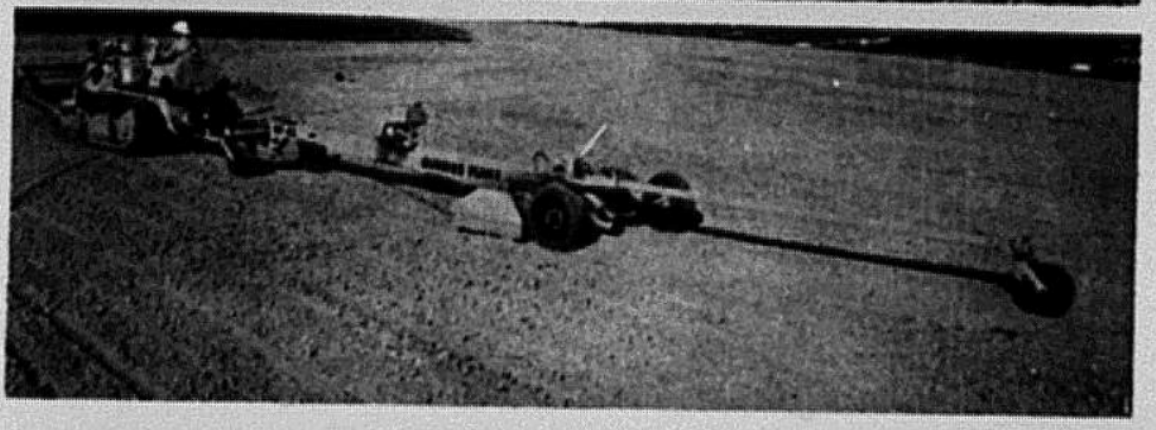

Ditch Construction and Land Preparation

In grading outlet ditches and cross-slope channels, efficient earth moving usually requires more than one type of machine. Motor graders are very effective for making field channels when all the earth is used to form the ridge on the down hill side.

Digging waterways without banks and straightening field channels by cutting and filling, requires equipment that can haul earth, such as wheel scrapers, front-end loaders, and trucks. If available, small wheel scrapers operated by two to four plow tractors can be used.

Finish grading of the ditch system and the smoothing of the land between ditches is done with land planes, shapers, or levelers. These machines, 20 to 40 feet long, operate automatically as they are pulled across the field.

In finishing the ditch system, one wheel of the smoothing machine is run along the ditch bottom and the other on the side slope. This is continued until the hump between the field surface and the side slope is removed. This operation is repeated for the other side of the ditch.

After the field is laid out and the ditch system constructed, the land must be worked. The land is plowed 8 to 10 inches deep after sod is destroyed. A stalk shredder or disc is used to break up stalks and corn hills on fields that were recently harvested. Several discings at different depths will loosen and mix the soil thoroughly. Soil must be well mixed to get even crop growth. Apply extra manure or complete fertilizer on scalped knolls after smoothing is finished will help secure uniform crop growth. If available, a heavy-duty pasture renovation disc will replace the plowing and ordinary discing.

Land Smoothing

After the field has been worked, the smoothing machine is operated over the entire field, preferably diagonally to the cross-slope channels. This eliminates major irregularities. A smoothing machine is used to grade the soil in the areas between the cross channels and the outlet ditches so water will drain readily. The final smoothing is done parallel to the cross-slope channels. When the blade is always carrying a small amount of soil, smoothing is complete.

To be effective, smoothing requires uniform grading to within

one inch on flat land, but there can be more variation on slopes over 2 per cent. If there isn't enough soil to fill major depressions, random shallow drainage channels are installed to connect these low areas to the main ditch system.

On very flat areas, smoothing should increase the grade between the cross-slope channels. If the land plane is hauled uphill so it begins loading at each channel, and it is mechanically dumped at the ridge below the next channel uphill, then there will be some increase in slope.

Summer or early fall is the best time to smooth land — when soil is dry, drying conditions are good, and rainfall infrequent. Soil should be loose, very dry, and free of trash. However, land must be smoothed as fast as possible since it is much more vulnerable to erosion in that state. If it must stand for some time, roughen the surface with a harrow or disc. Plan cropping in advance to reduce the amount of vegetative material present in the land forming operation.

Working the Field after Land Forming

With smoothing complete, the field can be worked in any direction with field cultivators on non-ridging (offset) discs.

Plowing with a reversible plow is best. Plan your plowing to leave a dead furrow in the channel and a back furrow on the ridge. This gradually increases the slope between channels.

The field may need more smoothing after soil has settled in the low areas. Be sure to plan additional maintenance with smaller equipment when the field is again plowed in the normal cropping sequence.

Land Forming Costs

Ditching costs from $5 to $15 an acre, depending on the amount of soil to be moved (either rolled from the ditch by graders or hauled into low areas) and the efficiency of the earth moving operation.

Smoothing costs between $10 and $15 an acre. At present, the Agricultural Conservation Program, through their cost-sharing payments available in many counties, will pay up to 50 per cent of both ditching and smoothing costs.

The Soil Conservation Service can help lay out drainage systems on farms of Soil Conservation District cooperators and Agricultural Conservation Program participants. See your county SCS office for further information.

Limitations of the System

Land forming is primarily a surface drainage system. It can't be highly effective on soils such as peats, mucks, and very flat marsh border soils that are normally saturated to near the surface. In addition to high water tables, such soils frequently have seepage zones and springy areas that require deep underdrainage -- tiling or deep ditching. On many areas, wise use of the surface drainage system combined with tile for underdrainage will give the most benefit at least cost.

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